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THE OUTBREAK OF TYPHOID AND DYSENTERY AT THE CHICAGO & ALTON SHOPS AT BLOOMINGTON[1]

BY M. C. SJOBLOM[2]

On February 17, 1920, the State Department of Health received word that an outbreak of intestinal disease had occurred at the Chicago & Alton shops at Bloomington. Accordingly an assistant engineer visited Bloomington and made a rather brief investigation of the situation. Later the author made several visits to the city to study the outbreak.

Nature of outbreak. Information received indicated that the main outbreak began about the middle of January. Severe intestinal disturbances were characteristic of a large number of cases. The early effects were described in many cases as being similar to those resulting from eating green apples. Others felt aches and were indisposed for a week or more before going to bed. The outbreak included probably between 300 and 400 cases of diarrhea, about 130 cases of typhoid, and resulted in at least fifteen deaths.

The Chicago & Alton shops are on the north side of Bloomington within a relatively short distance of the city water works. They employ a total of nearly 2000 men. The shops include a large locomotive repair shop, blacksmith shop, round house, steel car repair shop, paint shop, coach shop, wheel and axle shop, foundry, planing mill, store house, power house and a large office.

The nature of the disease and the large number of men affected by it at the shops naturally suggested at once that something used in common among the men must have been responsible for the outbreak. Furthermore, the fact that cases were confined to two shops suggested very strongly that the trouble lay therein. These two buildings are the locomotive repair shop and the blacksmith shop adjoining. The water supply at the shops was naturally first suspected as a source of infection and an investigation of it was made.

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[1] Read before the Illinois Section, March 25, 1920. Further discussions are invited and should be sent to the Editor.

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Water supply. The shops have a dual water supply. City water has been provided throughout them for drinking purposes, this water being available at fountains in the buildings. A second supply, ordinarily spoken of as the Chicago & Alton supply, has been provided for various purposes, including lavatory uses, flushing toilets, filling slack tubs in the blacksmith shop and testing locomotive boilers under hydrostatic pressure.

The Bloomington supply is received by the shops from the city mains at various points. A 6-inch pipe connects with the Morris Avenue main just west of the locomotive shops. A second connection from Morris Avenue enters the round house, thence other parts of the grounds. Three connections, two of which are 8-inch and the other 6-inch, are made along Chestnut Street. A sixth connection is made by means of an 8-inch pipe at Seminary Avenue just north of the shops. Some of these pipe lines are inter-connected but have valves provided for shutting off sections of these lines if desired. This water supply has normally a pressure of about 60 pounds.

The Chicago & Alton supply is normally obtained from what are known as the Lee Street Wells, located some distance south of the shops. An auxiliary supply has normally been secured from Sugar Creek, which passes north of the city, but due to a shortage of water here a second supply to be described was later used.

During the latter part of November, due to a breakdown in the water works at Normal, an additional demand was placed on the Bloomington water supply. The Bloomington supply was not sufficient, however, to furnish the entire abnormal demand, with the result that the level of the water in the city's large storage reservoir continued to fall. It was suggested by the water works officials, therefore, that the Chicago & Alton shops use as little city water as possible and accordingly it was decided to begin pumping water from Sugar Creek for industrial purposes at the shops.

A trip is said to have been made to see whether or not a satisfactory quantity of water was available in the creek. It was found that there was considerable water some distance upstream but practically none at the pumping station, which adjoins the Chicago & Alton tracks. Work was begun to clean out the stream bed so as to bring the water to the pumping station, but this plan was dropped before the work was completed and work was begun to tap the Normal sewer, which is across the creek from the pumping station. Two lines of 8-inch tile were first laid to carry the flow from the sewer to the suction well, but in making the necessary excavation the 33-inch Bloomington outlet sewer was uncovered within a few feet of the suction well at the pumping station. The work in connection with the Normal sewer was thus abandoned and the Bloomington sewer, which at this point is a 33-inch iron pipe used for crossing the creek, was tapped and its contents, consisting of sewage and creek water which had entered farther upstream through faulty joints, were pumped into the Chicago & Alton main. Pumping of this sewage was begun on November 26.

Pressure. The Chicago & Alton supply has two separate pressures. The water from the two principal sources is pumped into mains connecting into three relatively low tanks. This pressure is provided throughout the greater parts of the grounds. For purposes of testing and cleaning boilers and also for use on the flue rattler, a water supply under very heavy pressure is desirable. Therefore pumps have been provided which draw a supply of water from two elevated tanks south of the round house and force it into a system of mains serving the round house, the locomotive repair shop and the flue rattler, which is just north of the locomotive repair shop. These mains are inter-connected with the remainder of the Chicago & Alton piping but valves are provided for shutting off the high pressure section from the remainder of the system. That portion of the Chicago & Alton supply dependent upon the Chicago & Alton tanks for pressure has a pressure probably not exceeding 20 pounds at any point. The high pressure supply, on the other hand, varies from 120 to 180 pounds.

Cross-connections. Until recently there had been three connections between the city and the Chicago & Alton supply. One of these is located just east of the elevated tank on the main line from Sugar Creek. A single valve separates the supplies at this point. The second connection still existing is found at the power house. Here the pipes are so arranged that by means of two valves, city or Chicago & Alton water may be drawn for boiler purposes. Neither of these connections can normally cause any trouble, as the city water pressure is far greater than that afforded by the Chicago & Alton tank pressure. But even though this is the usual condition, it is quite conceivable how conditions might arise which would permit the contamination of the city water in the shops. It was stated that these connections were to be done away with immediately.

The third connection, which was in the locomotive repair shops, had been broken at the time of the author's visit, but as this connection doubtless was the cause of the trouble a detailed description will be given.

A pipe receiving its water supply from the Morris Avenue main entirely surrounds the locomotive repair shop. From the branch passing along the south wall of the building, a 2-inch pipe brings in a supply of city water for drinking purposes. Just inside the shop a shut off valve and a meter have been placed on the pipe, figure 1. From here the pipe passes up towards the ceiling and thence to the southeast corner of the building. Here one branch is carried down to the floor, and thence under the ground to the blacksmith shop and the store room. The main drinking water pipe, then, passes north near the ceiling along the east wall. Here a T has been placed in the pipe and a 2-inch connection made on which was placed a gate valve, which is connected with the Chicago & Alton supply.

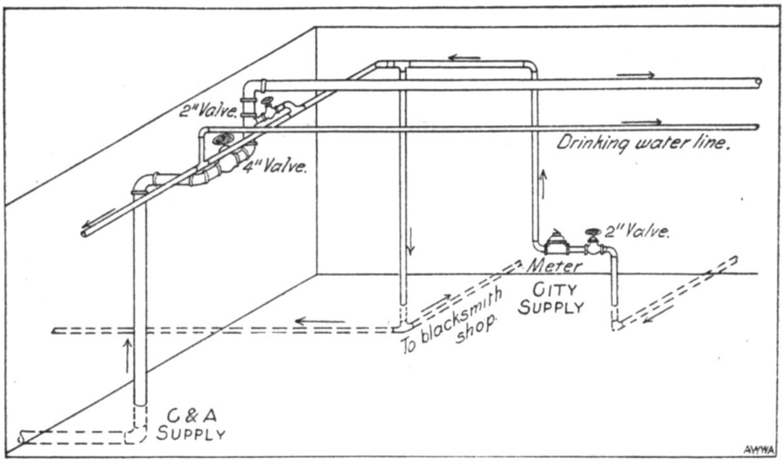

FIG. 1. CROSS-CONNECTION IN LOCOMOTIVE REPAIR SHOP OF MAIN SUPPLYING CITY WATER AND MAIN FILLED WITH SEWAGE

The Chicago & Alton supply comes into the shop through a 4-inch pipe along the east end of the building, passes upward along the wall, and thence passes westward to be used for toilet and lavatory purposes. A 4-inch valve was placed in this line just before it received the 2-inch pipe already referred to.

Ordinarily the Chicago & Alton supply, which was secured from the Lee Street wells, was used for toilet and lavatory purposes. Under these conditions the 2-inch valve was closed, and the 4-inch valve left open. However, when the creek water and sewage was to be pumped, the Chicago & Alton supply was shut off of these places by closing the 4-inch valve and the 2-inch valve was opened, thus providing city water to the toilets and lavatories in the locomotive repair shop.

Upon first studying the situation it was plainly seen how the water in the main locomotive shop was infected. But with a steady city pressure on the drinking water line and more or less leakage from fixtures, the contamination of the water in the blacksmith shop, where a number of cases occurred, did not appear quite so simple. Of course, even here with a heavy draught of water the flow might be reversed and carried into the blacksmith shop. However, it was learned that during January the foreman in the locomotive shop began shutting off the city supply after working hours. The pressure would therefore fall to zero, as there were many leaky fixtures.

With the city water shut off, there was a difference of pressure between the two sides of the 4-inch valve amounting to the Chicago & Alton water pressure here, which was 120 to 180 pounds. The 4-inch valve, when later examined, was found to leak. It is very plain, therefore, that this Chicago & Alton water filled the city pipe lines inside the shop every night and doubtless some also found its way here during other times.

It is not known whether or not the shutting off of the city water alone caused the outbreak to occur when it did. There is reason to believe that infectious matter may have been entering the water, at least in the locomotive repair shop, for some time, but if so the amount was doubtless less than later entered. There is also a possibility that the 4-inch valve had been operated to cause it to leak but there was no information to indicate this had occurred. There is even a possibility that the valve began to leak only after the city water was being shut off nights and the full pressure of the Chicago & Alton supply was against the valve.

The Chicago & Alton officials apparently suspected the cause of the trouble soon after the majority of the infections occurred. There is reason to believe that this occurred from January 15 to 23. On January 23, the 4-inch valve was broken and a blind gasket placed at a joint in the pipe. The danger apparently was removed on this date, but on February 6, for some unknown reason, this blind gasket was again removed. Some hours afterwards, however, the connection was severed by taking out an elbow in the 4-inch pipe. Whether or not any infection resulted during the short period on February 6, when the blind gasket was removed and the connection broken, can not be stated, but probably this did not result seriously as the connections with the sewer had been broken on January 27.

The fact that the store room adjoining the locomotive shops and the kitchen in connection with a bunk house camp, where water from the same pipes was furnished, had few or no cases at first appeared difficult to explain. Investigation showed, however, that at both of these places drinking water was brought from other sources. Water for the store room was brought from the coach yard and water used for drinking at the bunk house was carried from a nearby well. A single faucet in the kitchen had the city water, but here practically all was used for cooking and culinary purposes.

The situation at Bloomington is only one more reminder of the dangers of permitting connections between two water supplies, one of which is of safe quality and the other unsafe or questionable. Several Illinois cities have already paid dearly for their experience along these lines, and no time should be lost by such others as are similarly situated to have such connections removed.

DISCUSSION

Edward Bartow: Perhaps many of those present do not know how serious the epidemic in Bloomington has been. If the speaker recalls the figures rightly there have been over 30 deaths traced to the pollution. Safety is evidently a matter of cutting off all supplies from suspected sources from the city water supply. Rules have been laid down to that effect. Practically all of the epidemics that have occurred in Illinois have been due to some cross connection of this kind.

C. C. Williams: As superintendent of the Bloomington water Works, the speaker is present to listen rather than have anything to say. The author has covered the situation fully. Prior to this outbreak, the city had ordered the Chicago & Alton Railroad to carry its supply pipes from the city mains to the top of its gravity tanks, so that in the event the city pressure would be off the tank water could not flow into the city mains. This has not been done because of inability to get the materials.

M. C. SJOBLOM: The author intended to include in his report the number of deaths. There were between 300 and 400 cases of dysentery, about 130 cases of typhoid and 15 deaths of typhoid.

MR. BARBER: While the sewage, especially during the earlier days it was pumped, was somewhat diluted, later, perhaps during the last 30 days, it was very little diluted. The sewage which was pumped came from an area of one square mile of fairly well populated district. It came from about 10 miles of street sewers. That drainage district extends clear across the side of the city, from the northwest to the southeast corner of Bloomington.

LANGDON PEARSE: It may be of interest to the water works men present at this meeting from Indiana as well as Illinois, to point out that such conditions of dual water supply exist in many of the plants in the southern portion of Chicago as well as in the various steel mills and other factories in Lake County, Indiana. In the steel mills it is particularly necessary to have large volumes of water for cooling purposes. Inasmuch as the plant sewage often is discharged into the lake or river near the intake, the most available large supply is often polluted.

As a concrete illustration, the Health Department of Chicago, under Dr. Robertson, has given particular attention to weeding out typhoid and has undoubtedly done much to cut the typhoid death rate in Chicago to a figure lower than that for any other large city in the United States. In this crusade attention has been paid to very minute detail. As an illustration, during the war, Dr. Bundesen, the typhoid expert of the Health Department, asked the speaker to go down with him to the American Steel Foundry Plant at Indiana Harbor. On the way he said that twenty cases of typhoid had been reported in Chicago, which, by their record, were men who worked in the steel plant at Indiana Harbor. On arriving at the foundry it was found that the officials were thoroughly conversant with the facts and had acted very promptly to curtail further trouble.

This plant had three sources of water supply. The main source for cooling purposes was from the Calumet River. The intake was located 100 feet from the sewer of the plant. The water was consequently badly polluted. The drinking water supply of the plant was from a deep well, which had been cross-connected through a check and gate valve, with the cooling water supply. A third source of supply was from the city mains, consisting of chlorinated Lake Michigan water. This supply was seldom used except in emergencies. What had happened was that the polluted water from the river during times of low pressure had been passing directly into the elevated tank supplied by the well, and had been sent generally throughout the plant for drinking purposes. Upon the outbreak of the typhoid, the connection was promptly cut and steps taken to localize the infection.

The speaker has suspected for a long time that these dual sources of water supply in the industrial plants in the Calumet River district, particularly where badly polluted water is used for the larger and more available supply, is a very potent factor in keeping alive the typhoid fever death rate in the towns of Lake County.

C. A. Jennings: Supplementing the remarks of Mr. Pearse, the speaker would say that he has been in touch with some of the large corporations in the industrial district south of Chicago, and at least one of these will install chlorine apparatus for disinfecting their industrial water supply, even though the daily cost for chlorine will be about $50. The amount of water pumped is between 150,000,000 and 175,000,000 gallons per day. The source of the supply is from a slip into which boats come for unloading. The sewage from this plant goes into the slip a distance of about 100 feet from the water intake.

This water is not supposed to be used for drinking purposes and the company has placed signs at convenient places throughout the plant warning the men not to drink the water. Where there are several thousand employees and practically all nationalities are represented, it is difficult to have signs that all can understand and, furthermore, many cannot read even in their own language. Personal instruction has been resorted to, but when a man is thirsty, he may drink anything that looks like water and which is likely to quench his thirst.

The chief surgeon has recommended that this water be chlorinated to render it innocuous. Then if some employee drinks the water, he will not be rendered sick by doing so. The Americal Steel Foundries adopted this treatment some time ago, following an epidemic of sickness among its employees, and the Universal Portland Cement Company has decided to do the same thing as a precautionary health measure.